not grouped here. Except for the rapid heart, physical examination disclosed nothing of moment. As regards effects of cigarette-smoking and alcohol there is of course considerable divergence of opinion.

Cigarette-smoking undoubtedly has the effect of increasing the heart action, but that it has any more serious effect is dubious. J. Parkinson and H. Koefid,[61] in a recent article in which the effect of cigarette-smoking is fully discussed, conclude that the smoking of a cigarette by habitual smokers raises the pulse rate, which effect is more pronounced in cases of soldier's heart; that excessive smoking is not the essential cause in most cases, but in their opinion it is an important contributory factor in the breathlessness and precordial pain of many of them. R. D. Rudolf[62] says that the excessive use of tobacco is often stated to be a cause of soldier's heart, and no doubt in many cases it is one. Lewis, however, does not lay much stress on tobacco as a cause of disordered action of the heart. In his series 5 pe cent. did not smoke, and he calls attention to the fact that the same symptoms appear in soldiers who do not smoke. Likewise with alcohol, more than half of his cases were not consumers of alcoholic drinks and many of them showed actual distaste for it. Parkinson[63] found in his series of 40 cases that about half either smoked a pipe or were very light smokers, and that in regard to alcohol only 3 had been heavy drinkers. E. K. Tullidge[64] in his experience in Austrian service says that in a number of cases the disturbance could be traced directly to the excessive use of tobacco.

Fourteen cases of rapid hearts were seen which fell into no category. It was apparently impossible to group them satisfactorily.

Summary. "Soldier's heart" is discussed in the light of the experience of our allies. The importance of tachycardia as a prominent and important objective symptom in the examination of the recruit is called attention to and a classification for cases of tachycardia is suggested.

NECROPSY SERVICE IN A MILITARY HOSPITAL IN THE FIELD.

By Howard T. Karsner, M.D.,
CAPTAIN, M. R. C., U. S. ARMY, FRANCE.

The following report is offered not because of its statistical value but because it represents fairly well the type of work a pathologist sees in a base hospital in France and because it offers certain suggestions as to the sequences and treatment of war wounds. It represents eight months' service in a base hospital in France of about 1250 beds. The total number of necropsies is 87, which represents nearly all the deaths that occurred in the period mentioned. The necropsies were performed under fairly satisfactory conditions, and, as a rule, a few hours after death. There were no limits as to the extent of the examination, and bacteriological examinations were made in all cases. The finer differentiation of bacteria was not possible because of limitations of time and staff. The study of anaërobes was difficult, and the results given are to be regarded as approximations rather than as accurate diagnoses of the anaërobes. For this purpose the primary culture was made in a medium recommended by Hibler and by Muriel Robertson, composed of lean beef, and water, equal parts, rendered slightly alkaline to litmus, tubed and autoclaved. A final estimation of the cause of death was not possible in some of the more complicated cases, and the cause assigned was that dictated by a consideration of the clinical and pathological aspects of the case.

---

[61] The Immediate Effect of Cigarette Smoking on Healthy Men and on Cases of Soldier's Heart, Lancet, London, August 18, 1917, p. 232.

[62] Canadian Med. Assn. Jour., 1916, vi, 796.

[63] Loc. cit.

[64] The Heart of the Recruit and the Soldier, Military Surgeon, 1917, xl, 24.

Probably the most important phase of this report is the problem of dissemination of infection. Most of the war wounds contain several different organisms, and there appeared to be no explanation for the fact that in some cases the anaërobes are the most important for the patient, and that in other cases different forms of aërobes do the most damage. There were 28 cases in which streptococci were isolated from the heart's blood after death. Of these 2 were regarded as streptococcus pyemias, meaning metastatic suppurations in more than one position. The remainder are regarded as septicemias, although not all of them showed clinical symptoms. The technic of the heart cultures was very carefully controlled, and there is little likelihood that the organisms were contaminations; but there is always to be considered the possibility that they may have entered during the agony or after death. The cultures were pure except for 2 cases, in which Staphylococcus pyogenes aureus was also present and 5 in which an anaërobe was present as the result of gas gangrene, 4 being perfringens and 1 a motile organism, probably malignant edema. Only 1 case, a buttock wound, showed a demonstrable thrombophlebitis. Ten were cases of deep muscle wounds sometimes associated with bone injuries. Three followed penetrating head wounds, 3 penetrating pelvis wounds, 4 penetrating chest wounds and 9 followed wounds of the joints. Of these last 5 were of the knee-joint alone, 1 of knee and ankle, 1 of knee and elbow, 1 of hip alone and 1 of ankle alone. The seriousness of wounds involving the joints has been repeatedly emphasized by the surgeons, and much has been said and written about their treatment. This study can present no figures as to the frequency of septicemia as a complication, but does serve to draw attention to its importance, and any consideration of treatment must include this possibility. Attempts to save members, the joints of which are the seat of infection, must be most carefully guarded by close study of the case, and refractory cases should be subjected to most radical treatment, preferably amputation. There were 2 cases of pyemia due to Streptococcus pyogenes, 1 with large wound of buttock, fibrinous pleurisy and septic infarcts of the lungs and acute tricuspid valvulitis, 1 with penetrating wound of the pelvis, acute fibrinous pleurisy and septic infarcts of the lungs.

There were 7 cases in which Staphylococcus pyogenes aureus was isolated from the heart's blood; 3 of these were pyemias and 4 septicemias. In none of these were there wounds of joints, although 2 of the septicemias originated in chest wounds and 1 each of the pyemias and septicemias originated in penetrating wounds of the pelvis.

In addition to these septic cases there were 2 which were clinically and pathologically septicemic, but which were not identified bacteriologically because of faulty technic. There was 1 case of acute purulent meningitis due to Streptococcus pyogenes and apparently metastatic from an arm wound, although there was no growth in cultures from the heart's blood. Thirteen of the septic cases showed an acute valvular endocarditis; this matter, however, will be made the subject of a separate report. Of the 37 septic cases 27 showed spleens that were more than 150 grams in weight. There were 14 cases in which the liver weighed more than 2000 grams; 2 of these were not associated with enlargement of the spleen. The kidneys together weighed more than 300 grams in 21 cases, in 19 of which there was associated enlargement of the liver and spleen and in 2 there was associated enlargement of the liver only. Of the 37 cases only 5 failed to show parenchymatous change in the liver or kidneys or acute splenic hyperplasia. Of these 5 cases 4 were bacteriologically streptococcus septicemias and 1 was classed as a pyemia on the basis of gross morbid anatomy, but without bacteriological proof.

There were 17 cases of gas gangrene. Two of these died before the laboratory was equipped for satisfactory anaërobic work. Of the remaining 15 the heart's blood contained in 8 cases Bacillus welchii, in 2 cases a motile organism, believed to be the bacillus of malignant edema, and in 5 cases there was no growth. Of the cases showing organisms in the blood, the blood and tissues showed the usual foamy characters in all but one instance. Of the 5 showing no growth the organs and blood showed foamy change in 2 cases. In a general way it may be said that the cases reported "no growth" were sectioned earlier than those showing organisms, but one of the malignant edema cases was sectioned four hours after death and showed foamy organs. Most of the wounds were large deep wounds, 9 cases being thigh wounds, 3 of buttocks and pelvis (only one penetrating the gut), 3 arm and shoulder, 1 of the foot and 1 following an appendectomy; 5 of the cases were accompanied by a streptococcus septicemia. There are no particular notes to be made on the gross morbid anatomy of these cases, as the changes are well known and are modified in the usual way by the atmospheric temperature and the number of hours elapsed between death and autopsy. The cases were ill from three to fourteen days, the average being seven days. The average is raised by 2 twelve-day and 1 fourteen-day case, 4 being sick seven days and 7 being sick five days or less.

There were 12 cases of penetrating wounds of the chest. Most of these were studied bacteriologically before death by daily punctures of the chest. Frequently such punctures were sterile until four or five days after the wound had been inflicted, and such findings are common also in the non-fatal cases. Two of the cases should properly be classed as deaths from hemorrhage, one a hemorrhage into the chest following evacuation of a large amount of blood from the chest, the other showing frequent hemoptysis from a perforation of a branch of the pulmonary vein about 3 mm. in caliber. All but 2 cases showed a marked pleurisy, the 2 exceptions being cases of extensive old fibrous adhesive pleurisy, and 1 of these was a case that died of hemoptysis. Of the other 10 cases which showed acute pleurisy 9 had a bilateral involvement; 1 case showed also acute serofibrinous pericarditis; 5 cases had penetrating wounds of the lung and a bronchopneumonia; 1 of these showed also a most extensive acute interstitial pneumonia. Of the 7 cases without penetration of the lungs, 5 showed bronchopneumonia; 2 cases showed streptococcus in the heart's blood and 1 showed Staphylococcus pyogenes aureus. The fluid in the chests frequently showed the common wound flora, and a smear of the fluid, as a rule, could not be differentiated from a smear from a large superficial wound. In 1 of the cases Bacillus welchii was found in the heart's blood, although there was no foam in the blood and no evidence of gas gangrene. Most of these cases were ill about a week, but 1 was ill sixteen days, 1 ill twenty-one days and 1 ill twenty-seven days. The last showed a staphylococcus septicemia. The 2 streptococcus septicemias were ill nine and ten days respectively.

There were 9 cases of penetrating wounds of the head. These were all cases with penetration of the dura, but varied from cases with penetration of small pieces of shell or shrapnel to massive brain injuries with 3 cases of hernia cerebri. Six cases showed acute purulent basal meningitis, in 2 of which there was extension to the spinal meninges. In 3 of these cases, including the 2 with spinal involvement, there was pus in the ventricles. One other case showed an acute internal hydrocephalus associated with thrombosis of the lateral sinus, but no other evidence of infection. One case with basal meningitis and large wound of brain (tank rivet) showed extensive hemorrhage into the ventricles. Two cases died apparently of extensive subdural hemorrhage without real evidence of infection. None of the cases showed a septicemia. Five of the cases had been ill from two to nine days; 1 was ill twenty-eight days and died of meningitis; 1 was ill thirty-seven days and died of acute internal hydrocephalus; 2 cases which died respectively of brain abscess and meningitis lived forty and forty-five days.

There were 3 cases of penetrating wound of the spine. In one of these (sick nine days) there was fracture of the third lumbar vertebra, with hemorrhage in the pia arachnoid, but no suppuration. There was paralysis and anesthesia of the right leg and incontinence of retention, with acute hemorrhagic cystitis. Another case was sick four days and showed a shrapnel fragment embedded in the fourth thoracic vertebral body, severing the cord almost completely, with slight local purulent meningitis; there was a paraplegia and a most severe hemorrhagic cystitis. The third case, which lived twenty days, showed a small free shell fragment at the tenth thoracic region, with a profuse purulent inflammation of the membranes of the cord, the entire brain and the ventricles of the brain. There was no paralysis and no cystitis. None of the cases showed a septicemia, although the last case had had streptococci in his spinal fluid for more than ten days.

There were 9 cases of death apparently from hemorrhage; 6 of these had had more than 1 hemorrhage. Three of the latter group were chest wounds with penetration of the lung, one showing in addition a streptococcus septicemia. Of the 6 other cases the hemorrhage followed a wound of the pelvis in 1 and wounds of the lower extremity in 5 others; 2 of these 6 cases showed a streptococcus septicemia; 4 had been transfused without reaction, 2 cases once each, 1 case twice and 1 case three times. Of the total of 9 cases the spleen was enlarged in only 3, 2 of these having had a single transfusion, the other having had no transfusion but being a subject of a streptococcus septicemia. The bone marrow was normal. The case which had had two transfusions had been sick twelve days, was a streptococcus septicemia and had a spleen slightly enlarged (180 grams), but otherwise normal. The case which had had three transfusions had been ill sixty-nine days with an enormous buttock wound, was not septicemic and showed a soft spleen weighing 120 grams. The general results found in this series of cases was to the effect that transfusion with matched bloods shows little effect from the view-point of gross morbid anatomy. From the clinical and pathological observations it was decided that wounds of deep vessels in the thigh and about the knee were often so obscured by the depth and the infection and the irregularity of the wound that unless the hemorrhage after careful dissection and examination could be completely stopped the surgeon must consider the advisability of amputation for the purpose of controlling the bleeding. In civil surgery this might seem extremely radical, but the conditions of military surgery sometimes make it necessary.

In addition to the 9 foregoing cases of hemorrhage there were 3 of hemorrhage complicated by transfusion reactions. The first was a shell wound of the pelvis with repeated hemorrhage, which after a transfusion developed chills and cyanosis and died in a few hours. There was no hemoglobinuria, and the spleen aside from weight (160 grams) appeared to be normal. The second case had two transfusions following a single large hemorrhage from a shell wound of the pelvis, the second transfusion through a confusion of names resulting in the use of a group 2 donor for a group 4 recipient. At necropsy there was found a firm enlarged spleen (360 grams) hemoglobinuria, normal bone marrow and a streptococcus septicemia. The third case had 1 transfusion for a large hemorrhage from a shell wound involving the popliteal artery; there was immediate reaction followed in a few hours by death, and it was afterward found that a group 3 donor had been used for a group 2 recipient. There was no hemoglobinuria and the bone marrow was normal, but the spleen weighed 170 grams, was tense and showed numerous small hemorrhagic infarcts. This patient had been ill for twenty days and was clinically a case of septicemia, but cultures from the heart's blood at autopsy showed no growth.

There were 4 deaths following "mustard-gas" poisoning, an extremely irritant gas $(CH_2)_4Cl_2S$, which was first used by the German army in the summer of 1917. One of these showed a mild bronchopneumonia and suffered also from a Staphylococcus aureus septicemia following a shell wound of the pelvis. The other 3 cases had no wounds. They all showed skin burns of varying degree. The necropsies showed a dusky red congestion of all the viscera, including in 2 cases the brain, accompanied in the stomach by submucous petechiæ in the fundus. The conjunctiva and the membranes of the nose and pharynx were the seat of a marked mucous inflammation. The larynx, trachea and bronchi showed severe inflammation, in 1 case accompanied by pseudomembrane formatiom and in the other 2 with extensive necrosis of the mucosa, with multiple ulcers from 1 to 3 mm. in diameter. Two of the three showed acute fibrinous pleurisy. All showed a bilateral bronchopneumonia, with slight general edema of the lungs. The pneumonic patches were irregularly distributed, and varied in size from

2 mm. to 3 cm. in diameter, reddish gray or gray in color, solid, projecting in the cut surface, moist but finely granular.

Of the miscellaneous cases not justifying special description were 1 each of multiple pulmonary embolism, fat embolism, diabetes mellitus, malignant endocarditis (non-surgical), insufflation pneumonia following a traumatic tracheo-esophageal fistula, acute dilatation of the stomach in a case of congenital aplasia of the jejunum, ileum and colon.

It will be noted that in the eight months' service, from May 25 to January 25, there were no deaths from lobar pneumonia, although bronchitis and bronchopneumonia were of very frequent occurrence. There was no case of active pulmonary tuberculosis, although 10 cases showed the so-called healed lesions, small caseous or calcified areas surrounded by fibrous connective tissue. In addition to these cases there were 18 cases of chronic adhesive pleurisy without any evidence of tuberculosis to the ordinary careful gross examination. Of these, 10 were apical adhesions, 4 basal and 4 extensive, involving practically the entire pleura.

In passing from civil life to work in an active military hospital in the field the medical officer is beset by many difficulties and must readjust his point of view in regard to many things. The above series of necropsies was found to be of value in several respects. The results served to alter the surgical treatment of wounds of the extremities, particularly those involving joints to a considerable degree. In place of the conservative surgery of civil life which permitted in the badly infected war wounds the possibility of a septicemia, with its incident effects on internal viscera, there developed a more radical surgery which, although it might sacrifice a limb, assured the patient of survival with little chance of damage to important viscera. In regard to hemorrhage the postmortem examination of wounds showed the possibility of large vessels being wounded in such a way as to escape detection even with most careful operative dissection. This led to several amputations for the complete control of hemorrhage, undoubtedly to the advantage of the patients. Deaths from transfusion with antagonistic blood, which the necropsy showed to be largely due to the transfusion reaction and not to other causes, led to a firmer insistence on careful testing of the bloods before transfusion. It is believed that this is even more important, if possible, at the base where patients may have been drained by infection for days or weeks than in the hospitals near the front, as has been indicated in another paper.[1] The accurate diagnosis of cases permitted by postmortem examinations is undoubtedly an aid in the adjustment of pension and insurance claims as well as statistical value in the army medical service. With all these points in view it is urged that postmortem examinations should be established as a routine procedure because of their unquestioned value to the soldier, to the army and to the nation.

---

[1] Jour. Am. Med. Assn., 1918, lxx, No. 77, p. 769.